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54 **A unit for the preparation of beverages.**

57 This describes a unit for the preparation of beverages consisting of at least two liquid components. The unit has metering tanks (12, 24, 26, 27) to meter predetermined component quantities. The metering tanks are connected to a collecting tank (33), in which the metered component quantities are discharged in batch quantities. The metering tank (12) for the largest component (2) is designed as an overflow tank. During the mixing phase, its content flows through the metering tank of the smaller components that are metered by way of predetermined filling heights in their metering tanks. A mixing channel (32) located upstream of the collecting tank (33) receives the components flowing from the metering tanks and affects an intensive mixing already prior to reaching the collecting tank.

The invention concerns a unit for the preparation of beverages that consist of at least two liquid components with devices for metered combination and mixture of the components and with a collecting tank to receive the beverage mixture.

There exist many beverages that are mixed from several components according to a specific recipe. Lemonade, cola beverages and fruit juice beverages or similar are such beverages that can be prepared with or without carbon dioxide. They generally contain a large percentage content of a main component, generally water, and a smaller percentage content of at least one more component that gives the beverage its taste, appearance and character and is mixed with the water at a fixed ratio in the form of a liquid concentrate or syrup. Since the customer always expects to get the known properties of taste, appearance etc. from his beverage, predetermined mixing ratios must be maintained in adherence to strict requirements. Accordingly, a mixing device must ensure a most accurate metering and mixing of the components to be mixed.

A mixing device for beverages is known from DE-AS 1 473 137, in which the component quantities to be added are continuously metered to a collecting tank. To achieve this, each component has an overflow tank to which the component is piped continuously in such a quantity that a part of the liquid overflows continuously. This produces a liquid column of a constant height in the overflow tank, thus creating constant pressure conditions at the outlet located at the bottom of the overflow tank. The outlet exhibits a predetermined flow resistance corresponding to the desired percentage part of the respective component and the constant pressure ensures that just the required liquid quantity flows into the collecting tank where it is mixed with the liquid from the second overflow tank. Other mixing units of this type with a continuous metering of the component flowthrough are known from DE-AS 24 19 353 and DE-PS 27 04 027.

The task of this invention consists in the presentation of another mixing unit of the type described earlier.

In accordance with the invention, this task is solved by the fact that at least one metering tank is provided for each component that receives a predetermined component quantity, is fitted with at least one closing liquid inlet and at least one closing liquid outlet, and that the collecting tank is connected to the liquid outlets of the metering tank.

In contrast to the units of the prior art, the metering in the unit in accordance with the invention occurs in batches through a sequential filling and draining of the metering unit. Volumetric metering offers the advantage of precise metering and good cleaning possibilities. The lack of metering pumps simplifies the unit, its control and its cleaning.

Further developments of the invention with the significance of an autonomous protection possibility, as well as advantageous and appropriate designs, are contained in the sub-claims.

The fact that the metering volumes of the metering tanks can be adjusted at least for the smaller components according to claim 2 offers a wide range of possible mixing ratios., i.e., the mixing unit in accordance with the invention exhibits a high flexibility. The fixed metering volume of the metering tank for the largest component according to claim 3 prevents metering errors and this is particularly advantageous because a metering error with the largest component has a particularly severe effect on the mixing ratios. In this regard, the fact that the metering tank for the largest component is designed as an overflow tank is of great significance, since this offers an extremely accurate metering of this largest component. Accordingly, this further development of the invention has an independent significance of inventiveness. The measuring and setting of the filling height for the smaller components in their metering tanks described in claim 5 as a further development of the

invention saves the need for mechanical volume-setting devices with undesirable seals and simplifies the cleaning of the tanks. By enlarging the horizontal cross-section of the metering tank toward the top according to claim 6, the effects of a measuring error in the filling height measurement on the mixing ratio in the collecting tank can be maintained constant and independent of the filling quantity. This concept also exhibits the rank of independent inventiveness. Claims 7 through 9 concern a two-section design of the metering tank for the largest component that is considered independently patentable. It increases the variation range for the mixing ratios and also offers a very advantageous possibility to drain the tank through two separate outlets into the collecting tank. This may improve the component mixing and also increases the operating speed of the unit. When the metering tanks for the smaller components according to claim 10 are installed downstream of the metering tank for the largest component, at least a part of the largest component, i.e., water, will flow through the smaller tanks during the draining. Accordingly, the mixing phase begins already with the draining of the metering tanks and not only after reaching the collecting tank, thus further improving the mixing effect. Furthermore, this arrangement ensures that no percentage parts of the smaller components remain in the smaller metering tanks.

According to claim 11, a further mixing improvement is achieved by installing a mixing channel, into which the outlets of the metering tanks run, upstream of the collecting tank. This concept is also independently patentable.

Claim 12 envisions a special arrangement and design of the metering tanks for the smaller components, i.e., parallel to each other and with a joint vapor space. This makes it possible to connect all these tanks to a joint outlet of the largest metering tank and the largest component thus flows simultaneously through these tanks. This also improves the mixing effect. A bypass line that, in accordance with claim 13, originates at the metering tank of the largest component or at its outlet after the metering tanks of the smaller components to the collecting tank or mixing channel prevents the formation of higher concentrations of the smaller components in the collecting tank at the start of the mixing process and thus also improves the mixing effect. This is also seen as independently patentable.

When the vapor spaces of the liquid tanks are in a suitable manner connected to a gas pressure source and particularly a CO_2 source in accordance with claims 15 and 16, the unit can be used to mix carbonated beverages. In that manner, the components and prepared mixture are purged and impregnated with CO_2. It is possible to maintain a gas flowthrough, thus increasing the economics of the gas consumption. When the vapor spaces above the smaller components from a gas flowthrough are excluded, this step provides aroma protection, since volatile aroma substances remain in the component tanks.

A liquid circulation system that is connected to the storage tank of the largest component and includes the content of the storage tank in accordance with claims 17 through 19 offers the possibility of additional mixing with CO_2 that improves the degree of CO_2 saturation in the liquid.

Overall, the invention offers the advantages of a mixing unit with an accurate metering of the components to be mixed. The achievable component mixing effect is optimal and the carbonization of beverages containing carbon dioxide is improved further. In addition, the unit in accordance with the invention offers the possibility of a reliable and simple cleaning of the unit as well as a mixing in batches and with a high performance. At the same time, the aroma from the components that determine the taste is maintained at an optimal level. The unit is a simple design and ensures reliable operation.

The invention will now be explained in more detail with the help of the drawings. The following is shown:

Figure 1 shows a schematic representation of a unit in accordance with the invention;

Figure 2 shows another version of the design and arrangement of the metering tanks in a unit according to Figure 1; and

Figure 3 shows another version of the design and arrangement of the metering tanks in a unit according to Figure 1.

Figure 1 shows a schematic representation of a unit in accordance with the invention. The unit is designed for the preparation of carbonated beverages consisting of no more than four components. The largest component - generally water - is kept ready in storage tank 1. Water 2 is supplied through pipe 3 that can be closed with valve 4 and enters vapor space 6 of storage tank 1 above the water level. A suitable gas - generally carbon dioxide (CO_2) - that again leaves the vapor space of the storage tank through gas line 8 is supplied to vapor space 6 through gas line 7. The water supplied through line 3 is injected into vapor space 6 through injection nozzles 3a; it is thus aerated at least in part and it absorbs CO_2.

The storage tank is connected to metering tank 12 for the largest component by way of supply line 9 that can be closed with valve 11. Metering tank 1 is designed as an overflow tank, whose overflow edge 13 determines the metering volume of metering tank 12 in return flow pipe 14 that connects the metering tank with the respective storage tank 1. Outlet 16 of metering tank 12 can be closed with valve 16a.

Other liquid components 21, 22 and 23 are kept ready in storage tanks 17, 18 and 19. Through pipes 17c, 18c and 19c that can be closed with valves 17a, 18a or 19a, the storage tanks for the smaller components are connected to metering tanks 24, 26 and 27 for the smaller components. Furthermore, throttle valves 17b, 18b and 19b are provided in pipes 17c, 18c and 19c.

Each metering tank 24, 26 or 27 is fitted with level indicator 28 to determine the liquid level of the respective component in the metering tank. Each metering tank has liquid outlet 29 that can be activated with valve 31 and ends in mixing channel 32. Mixing channel 32 is connected to collecting tank 33 in which occurs the complete mixing of the combined components. A liquid bypass with pump 36 is connected to collecting tank 33 and supports the mixing of components contained in mixture 37 in collecting tank 33.

Metering tanks 24, 26 and 27 exhibiting the same or a different capacity, are fitted with a joint vapor space 38 above the liquid level, in which ends outlet 16 of metering tank 12 of the largest component by way of outlet valve 16a. It is thus ensured that the liquid quantity of the largest component measured in metering tank 12 flows through metering tanks 24 through 27 prior to reaching collecting tank 33. This results in an improved mixing of the components and also yields the advantage that no residues of the smaller components remain in metering tanks 24 through 27. Mixing channel 32 installed upstream of collecting tank 32 already offers a mixing of the liquid components before they reach collecting tank 33. This ensures fast component mixing.

Gas return pipe 39 connects the vapor space of metering tanks 24 through 27 of the smaller components with the vapor space of collecting tank 33.

By way of pump 41 and through pipe 42, the mixture prepared in collecting tank 33 is removed and supplied under pressure into post-mixing tank 43. In that connection, liquid mixture 37 flows through carbonation section 44, e.g., an injector nozzle, to which is supplied CO_2 gas through gas supply pipe 47 and by way of connecting pipe 46. Connecting pipe 46 branches from gas supply pipe 47 that ends in vapor space 48 of post-mixing tank 43. The finished carbonated mixture is

removed through discharge pipe 49 fitted with valve 49a and is piped to a filling unit to fill it into small containers or large drums.

A permanent CO_2 flowthrough to gas outlet pipe 8 is maintained by way of gas supply pipe 47, vapor space 48 of post-mixing tank 43, connecting pipe 51 that connects the vapor space of the post-mixing tank with the vapor space of collecting tank 33, gas supply pipe 7 and vapor space 6 of storage tank 1 for the largest component. An optimal aeration and carbonation of the beverage is achieved with this gas flow that runs in the opposite direction of the liquid flow. Vapor space 38 of metering tanks 24 through 27 is through gas return pipe 39 connected with the vapor space of the collecting tank and is not included in the gas flowthrough system. The vapor spaces of storage tanks 17 through 19 for the smaller components are also not included in the gas flowthrough system, but are connected to the CO_2 supply only through a branching pipe 52. Thus is ensured that volatile aroma material is not flushed out of the smaller components by the gas flow.

Bypass pipe 53 with valve 53a that returns immediately to storage tank 1 branches from filler pipe 9 that connects storage tank 1 for the largest components with metering tank 12. With the help of pump 34 and open valve 53a, it is thus possible to maintain a water circulation in which the water is aerated and carbonated by way of carbonation device 56 in the form of an injection nozzle. Injection nozzle 56 is supplied with CO_2 through pipe 57 connected to vapor space 6 of storage tank 1.

Valve 53a of bypass pipe 53 is closed to fill metering tank 12 for the largest component. Pump 34 then pumps the water through filler pipe 9 into metering tank 12. Bypass valve 53a will be opened toward the end of the filling process, thus reducing the filling speed in metering tank 12. Filler valve 11 is closed when the liquid flows across overflow edge 13. Since pump 34 continues to operate, the water circulation through bypass 53 is maintained, thus ensuring continuous water carbonation in carbonation device 56. At the same time and through pipe 3, fresh water is supplied and injected through nozzles 3a into the vapor space of the storage tank.

Metering tanks 24 through 27 for the smaller components are also filled during the filling of metering tank 12. To do so, valves 17a, 18a and 19a are opened to permit the components from storage tanks 17, 18 and 19 to flow to the metering tanks. Flow control valves 17b, 18b and 19b are activated prior to reaching the desired liquid level, thus decreasing the liquid supply flow and increasing the metering accuracy. Liquid level indicators 28 are connected to control unit 58 (see Figure 2) that determines the required liquid level for the metering process in all metering tanks for the smaller components. As soon as the required liquid level is reached, the respective valve 17a, 18a or 19a is closed to interrupt the liquid supply flow.

Outlet valves 16a and 31 are then opened to let the metered component quantities flow from the metering tanks to mixing channel 32 and collecting tank 33. In that regard, the largest component flows from metering tank 12 through metering tanks 24 through 27 for the smaller components and thus affects a very good component mixing as well as a flushing of metering tanks 24 through 27. As soon as the metering tanks are empty, outlet valves 16a and 31 are closed again and a new metering cycle can be started.

As shown in Figure 1 for metering tank 24, the horizontal cross-section of this metering tank widens from the bottom to the top. The other metering tanks for the smaller components can be of the same design; however, this is not indicated in Figure 1 for reasons of simplicity. This cross-section widening ensures that a measuring error made by level indicator 28 when determining the filling height has the same effect on each volume to be measured. Accordingly, it is possible to

always make a reliable determination about a possibly occurring metering error for each mixing ratio.

Figure 2 shows a version of the metering device for the mixing unit shown in Figure 1. Equal parts are designated with the same reference number as in Figure 1.

Figure 2 shows metering tank 12 for the largest component with outlet 16 and outlet valve 16a. As shown in Figure 1, metering tank 12 is designed as an overflow tank fitted with overflow edge 13 in return pipe 14 that determines the filling volume of the metering tank. Outlet 16 of metering tank 12 ends at the top of metering tank 24 for a smaller component. Through pipe 17 fitted with valve 17a, this metering tank is connected to a storage tank for this component that is not shown here. As shown for the unit in Figure 1, outlet 29 with outlet valve 31 ends in mixing channel 32 that is connected to a collecting tank not shown here. The filling height of the component in metering tank 24 is determined with liquid level indicator 28 and is adjusted to the predetermined height by control unit 58 and supply valve 17a.

Bypass pipe 59 connects vapor space 38 of metering tank 24 with mixing channel 32. When metering tanks 12 and 24 are drained through outlets 16 and 29 and outlet valves 16a and 31, a part of the largest component that accumulates in vapor space 38 of metering tank 24 after outlet valve 16a is opened flows through bypass pipe 59 and, after metering tank 24, directly into mixing channel 32. In that manner, the two components are mixed in mixing channel 32 already at the start of the mixing process, thus preventing higher concentrations of the smaller component from metering tank 24 from the beginning. This substantially improves the component mixing.

As shown in Figure 2, metering tank 12 for the larger component has tank section 61 with a greater volume. In the design form shown, tank section 61 is arranged in the liquid supply pipe and can be used for the mixing process by way of outlet valve 62, if required. Through filler pipe 9 and filler valve 11, metering tank 12 will be filled from a storage tank (not shown) and through tank section 61 as shown in Figure 1. Tank section 61 with its greater volume increases the flexibility of the metering and mixing device, since it expands the selection of mixing ratios. Furthermore, the arrangement of tank section 61 shown in Figure 2 forms a bypass that bypasses metering tank 24 for the smaller components. When outlet valve 62 is opened during mixing in addition to outlet valves 16a and 31, a part of the larger component flows from tank section 61 directly to mixing channel 32 and affects there an early component mixing, thus preventing a concentration of just one component that would have to be remedied with special measures thereafter. When the volume of tank section 61 is not required for the mixing of the beverage, outlet valve 62 remains closed and only the content of metering tank 12 flows through outlet valve 16a. Since metering tank 12 is filled through tank section 61, the content of the tank section is renewed with each metering process.

Figure 3 shows another version of the metering device in the mixing unit shown in Figure 1. The metering tank for the larger components is designated here as number 63. It is also designed as an overflow container that, through return pipe 64, is connected to a storage tank (not shown here) for the larger component (water). The water is fed through filler pipe 66 fitted with filler valve 67. By way of outlet valve 69, outlet 68 of metering tank 63 is connected to a downstream metering tank 71 for the smaller component. By way of supply pipe 72 and supply valve 73, metering tank 71 is connected to storage tank 74 for the smaller component. Gas return pipe 76 fitted with valve 77 connects metering tank 71 with vapor space 78 of storage tank 74. Second component 81 is supplied to storage tank 74 through connecting pipe 79 in such a manner that a predetermined liquid level is maintained as accurately as possible.

Metering tank 71 is fitted with sliding piston 82 to adjust the metering volume of the metering tank. By way of outlet valve 84, outlet 83 is connected to a collecting tank or a mixing channel as shown in Figures 1 and 2.

The components are metered by filling metering tank 63 through filler pipe 66 to the overflow. Supply valve 73 is opened at the same time, thus permitting the second liquid component 81 to flow through supply pipe 72 to metering tank 71 for the smaller component. Since metering tank 71 and storage tank 74 are connected in the form of communicating containers, the second component rises in gas return pipe 76 to the liquid level in storage tank 74. Valve 73 is closed once this level is reached and valves 69 and 84 are opened to initiate the mixing process. The metering accuracy offered by this metering device is extremely high since the cross-section of gas return pipe 76 can be very small and level variations that may occur in storage tank 74 have only a minor effect on the measured volume.

To prevent the liquid from flowing through gas return pipe 76 to storage tank 74 at the process start, valve 77 will be closed no later than the time at which outlet valves 69 and 84 are opened.

Figures 2 and 3 show only one metering tank and one storage tank for a smaller component. It is clear that several metering tanks and several storage tanks for several smaller components can be arranged in a parallel manner as shown in Figure 1.

Patent claims

1. A unit for preparing beverages from at least two liquid components fitted with devices for achieving a metered combining and mixing of the components and with a collecting tank to collect the beverage mixture, characterized by the fact that a metering tank (12, 24, 26, 27, 71) is provided for each component (2, 21, 22, 23) to receive a predetermined component quantity and is fitted with at least one closing liquid inlet (9, 17c, 18c, 19c, 72) and at least one closing liquid outlet (16, 31, 83), and that the collecting tank (33) is connected to the liquid outlets of the metering tanks.

2. A unit in accordance with claim 1, characterized by the fact that the devices (28, 58, 82) to set the respective desired metering volume are provided for the metering tanks (24, 26, 27, 71) for the smaller components.

3. A unit in accordance with claim 1 or 2, characterized by the fact that the metering tank (12, 63) for the largest component (2) has a fixed metering volume.

4. A unit in accordance with one of claims 1 through 3, characterized by the fact that the metering tank (12, 63) for the largest component (2) is designed as an overflow tank and that the metering room located below the effective overflow edge (13) determines the metering volume.

5. A unit in accordance with one of claims 1 through 4, characterized by the fact that the measurement and control devices (28, 58) to control the supply (17c, 18c, 19c, 72) for the respective smaller components until the respective predetermined liquid level is reached are provided for the metering tanks (24, 26, 27, 71) for the smaller components.

6. A unit in accordance with one of claims 1 through 5, characterized by the fact that the horizontal cross-sections of the metering tanks (24, 26, 27) for the smaller components increase toward the top.

7. A unit in accordance with one of claims 1 through 6, characterized by the fact that an additional tank section (61) for optional use is provided for the metering tank (12) for the largest component (2).

8. A unit in accordance with claim 7, characterized by the fact that the additional tank section (61) is connected to the metering tank (12) by way of a liquid flowthrough section connected at the upper tank section and that it has a separate closing liquid outlet (62) toward the collecting tank (33).

9. A unit in accordance with claim 7 or 8, characterized by the fact that the additional tank section (61) is arranged upstream of the metering tank (12) for the largest component (2) in the supply pipe (9) for the largest component.

10. A unit in accordance with one of claims 1 through 9, characterized by the fact that at least one of the metering tanks (24, 26, 27, 71) for the smaller components is connected to the liquid outlet (16, 68) of the metering tank (12, 63) for the largest component (2) and also to the liquid inlet of the collecting tank (33).

11. A unit in accordance with one of claims 1 through 10, characterized by the fact that the liquid outlets (29, 83, 59, 62) of the metering tanks end in a mixing channel (32) that is connected to the collecting tank (33).

12. A unit in accordance with one of claims 1 through 11, characterized by the fact that several metering tanks (24, 26, 27) for smaller components (21, 22, 23) are arranged parallel to each other and have a joint vapor space (38).

13. A unit in accordance with one of claims 1 through 12, characterized by the fact that the metering tank (12) for the largest component (2) is by way of the bypass pipe (59) and after the metering tanks (24, 26, 27) for the smaller components connected to the collecting tank (33) or the upstream mixing channel (32).

14. A unit in accordance with one of claims 1 through 13, characterized by the fact that moving displacement elements (82) are provided as the device to set a predetermined metering volume in the metering tanks (71) for the smaller components.

15. A unit in accordance with one of claims 1 through 13, characterized by the fact that the vapor spaces of the liquid tanks are connected to a gas pressure source and that the metering and mixing process occurs under increased pressure.

16. A unit in accordance with claim 15, characterized by the fact that means are provided to maintain a gas flowthrough through the vapor spaces of the collecting tank (33) and of the storage tank (1) for the largest component (2) and that the vapor spaces of the storage and metering tanks (21, 22, 23, 74; 24, 26, 27, 71) for the smaller components are connected to the gas system but are excluded from the gas flowthrough system.

17. A unit in accordance with one of claims 1 through 16, characterized by the fact that a closable supply pipe (9) connects the storage tank (1) with the metering tank (12) for the largest component (2), that a pump (34) is provided to pipe a predetermined quantity of the largest component into the metering tank, that a closable bypass pipe (53) branches from the supply pipe and returns to the storage tank (1) and that the control units (11, 53a) are provided to block the supply pipe (9) after filling the metering tank and to maintain a liquid circulation through the bypass pipe (53) to the storage tank.

18. A unit in accordance with claim 17, characterized by the fact that at least one carbonation device (56) is assigned to the supply pipe (9) upstream and before the branching of the bypass pipe (53).

19. A unit in accordance with claim 18, characterized by the fact that a mixing nozzle connected to the carbon dioxide gas source is provided as carbonation device (56).

Fig. 1

Fig. 2

Fig. 3

European Patent Office

EUROPEAN SEARCH REPORT

Application No.

EP 91 11 6385

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Document designation with indication of the relevant passages, where appropriate	Relevant to claim No.	APPLICATION CLASSIFICATION (Int.Class.5)
X	EP-A-0 382 025 (ORTMANN & HERBST GMBH)	1-3,5,14, 15	B 67 D 1/00 B 67 D 5/56
Y	(*the whole document*)	4,11	B 01 F 3/04
	- - -		
D,Y	DE-B-1 473 137 (MOJONNIER BROS. CO.) *column 2, line 60-line 63; Figure**	4	
	- - -		
Y	US-A-3 516 431 (SUNDT ET AL.)	11	
A	(*Figure 2*)	6	
	- - -		
X	DE-A-3 132 706 (ORTMANN & HERBST GMBH) *the whole document*	1,10,15, 16	
	- - -		
A	EP-A-0 335 598 (BARKER, BRETELL & DUNCAN) *column 4, line 19; column 5, line 22; Figures 1,4**	1	
	- - -		
A	FR-A-2 126 102 (BOUJAREL) *column 4, line 3-line 13; Figure 1**	1	

TECHNICAL FIELDS SEARCHED (Int.Class.5)
B 67 D B 01 F B 67 C

The present search report has been prepared for all patent claims

Place of search	Date of search completion	Examiner
The Hague	January 17, 1992	MARTINEZ NAVARRO A

CATEGORY OF CITED DOCUMENTS

X: Particularly relevant if taken alone.
Y: Particularly relevant if combined with another document of the same category.
A: Technological background.
D: Document cited in the application.